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OROBITTACUS OBSCURUS, A NEW GENUS AND SPECIES OF BITTACIDAE (MECOPTERA) FROM CALIFORNIA

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Genera in the Bittacidae have traditionally been differentiated primarily on the basis of wing characters—fusion of veins, number of costal cross-veins, reduction or loss of wings, etc. Descriptions of most genera have included little about other structural details. Probably this has been due largely to the fact that most genera, when described, were monotypic so that the difference between generic and specific significance of taxonomic characters was not yet clear. Their authors observed greater differences in characters of antennae, legs and genital structures within the large genus *Bittacus* Latreille than between *Bittacus* and the new genera. Rarely, there has been an exception, for example, *Pazius* Navás, distinguished by large, contiguous compound eyes. Byers (1972) discussed this problem in relation to *Kalobittacus* Esben-Petersen, *Nannobittacus* Esben-Petersen and *Issikiella* Byers.

Accordingly, Smithers' (1973) discovery of the remarkable Australian *Tytthobittacus macalpinei,* which differed from other Bittacidae more in male genitalia than in venation, came as a surprise. Two characteristics of this species are striking: the cerci are greatly enlarged, extending beyond the apices of the basistyles, and the ninth abdominal tergum is a medially notched, horizontally-oriented plate (rather than two vertically-aligned lobes, as in all other bittacids).

An even more surprising species, recently discovered in central California, also has greatly lengthened and widened cerci in the male. Its ninth abdominal tergum is more modified than that of *Tytthobittacus,* being produced backward as a single median lobe with terminal, claw-like spines, and solidly fused to the ninth sternum at the sides. The dististyles in this species are not small and simple, as in Bittacidae generally, but large, bilobed and of complex structure. In both sexes the antennae are conspicuously long, and the wings have no pterostigmal cross-veins.

Except for the cerci, these characteristics recalled *Anabittacus iridipennis* Kimmins of southern Chile. This led to a re-examination of males of that species, dissection revealing that the supposed lobes of the ninth tergum are in fact enlarged cerci, arising close beneath the inconspicuous, downturned tergum (cf. Byers, 1965:136, figs. 1, 5). *Anabittacus* turns out to be, in several respects, intermediate between *Tytthobittacus* of eastern Australia and the new genus from California, a circumstance that agrees well with our current concept of continental drift as a factor in zoogeography of Mecoptera.

Orobittacus, new genus

This genus includes bittacids in the wings of which vein R_{2+3} is unbranched, pterostigmal cross-veins are absent but a single cross-vein connects R_1 and R_{2+3} far before the stigma, and M_4 branches from M_3 beyond the m-cu cross-vein; in which the antennae are nearly as long as the body or slightly longer and have 34 or more flagellomeres; and in males of which the ninth abdominal segment is a continuously sclerotized ring with a single, median, dorsal projection, the cerci are longer than the basistyles and broadly spatulate, and the dististyles are large, complex and two-branched.

Type species.—Orobittacus obscurus, new species.

The generic name is derived in part from both Greek and Spanish (Greek *oros* = mountain, Spanish *oro* = gold, + *Bittacus*), referring to the occurrence of the type species in the Sierra Nevada, particularly in the region where gold was discovered in 1848 on the American River, not far below the type locality.

Orobittacus can be differentiated from other genera of Bittacidae in the Western Hemisphere by the following key:

Key to Genera of Bittacidae of the Western Hemisphere

1. Antennae nearly as long as body or slightly longer; cross-vein between R_1 and R_{2+3} far before pterostigma, approximately opposite level of tip of Cu_1; ninth abdominal tergum and sternum of male fused into continuous ring; cerci of male projecting farther caudad than any part of ninth tergum 2

   Antennae less than half as long as body; one or two cross-veins between R_1 and R_{2+3} behind pterostigma (or wings absent); ninth abdominal tergum and sternum of male separated laterally by membranous pleura; cerci of male usually much shorter than caudal prolongations of ninth tergum 3

2. Vein M trifurcate at first fork (M_{1+2}, M_3 and M_4 having single origin); R_2 and R_3 separated before wing margin, Rs thus with four branches; in male, ninth abdominal tergum with two short, downturned submedian lobes, ninth sternum with narrowly triangular median projection (southern Chile and Argentina) .... *Anabittacus* Kimmins

   Vein M bifurcate at first fork (M_4 originating from M_3 well beyond first fork of M); R_2 and R_3 coalesced to wing margin, so Rs has only three branches; in male, ninth abdominal tergum with one median projection directed caudad, posterior margin of ninth sternum entire, without median projection (California) .... *Orobittacus,* new genus

3. Wings absent (California) .... *Apterobittacus,* MacLachlan
   Wings present 4
4. In front wing, vein 1A short, extending at most to level of origin of M, often only slightly beyond level of humeral cross-vein 5
   In front wing, vein 1A extending approximately to level of first fork of M, i.e., far beyond origin of M 8
5. Vein 1A in front wing extending approximately to level of origin of M; two pterostigmal cross-veins (Pcv) (México and Central America) .... *Kalobittacus* Esben-Petersen
   Vein 1A in front wing extending only slightly past level of humeral cross-vein; only one Pcv 6
6. Compound eyes enlarged, touching on front of head beneath antennae; abdomen extremely long and slender, extending far beyond tips of wings (Central America and northern South America) ... . *Pazius* Navás
   Compound eyes not touching on front of head; abdomen not extending beyond wing tips, or only slightly beyond them 7
7. Subcosta ending in costa (C) before level of first fork of radial sector (FRs); subcostal cross-vein (Scv) near level of origin of Rs; vein Cu_2 in front wing ending opposite first fork of M (Brasil and Bolivia) .... *Issikiella* Byers
   Subcosta ending in C well beyond FRs; Scv well beyond origin of Rs; in front wing, Cu_2 ending well beyond level of first fork of M (Panamá, Colombia, Venezuela, Brasil) .... *Nannobittacus* Esben-Petersen
8. Costal cell with 4 or 5 cross-veins beyond humeral cross-vein (h); wings broadly banded and spotted with brown (Brasil) .... *Neobittacus* Esben-Petersen
   Costal cell with 0 to 3 cross-veins, usually 0 or 1, beyond h; wings not extensively banded but may be spotted or have narrow darkened zones along some cross-veins or veins 9
9. Wings hyaline with smoky gray or black spot at apex; only one Pcv (eastern United States, possibly México) .... *Hylobittacus* Byers
   Wings usually tinged with yellow or yellowish brown, without darkened apex; usually two Pcv (one in some South American species) (United States, southeastern Canada, México, Central America, South America) .... *Bittacus* Latreille

Orobittacus obscurus, new species

Description based on 191 ♂♂, 122 ♀♀ pinned and 86 ♂♂, 76 ♀♀ preserved in alcohol.

Head.—Dorsal occiput, vertex and frons above antennal bases shining black, grading into blackish brown on occipital-postgenal surfaces behind eyes and on small median swelling immediately below and between antennal sockets. Rostrum and palps generally dark yellowish brown, labrum slightly darker. Eyes dark plum colored, slightly convergent below antennal bases. All three ocelli of approximately same diameter, on prominent elevation. Anterior tentorial pits conspicuous but epistomal suture otherwise obliterated. Rostrum slender but short; labrum only a little more than twice as long as width at base. Mandible with a single subterminal tooth; maxillary lacinia bearing brush of hairs at apex, fifth segment of maxillary palp shorter than fourth, without hairs. Antennae long (about 16 mm in both sexes), if drawn out along costal wing margin extending to mid-length of pterostigma, comprising thick subcylindrical scape, pedicel, and 38–39 distinct flagellomeres in male, 34–37 in female.

Thorax.—Pronotum shining black with thin, pale hairs along anterior margin, hairs increasing in length from mid-line toward sides. Mesonotum and metanotum shining black to brownish black with sparse, fine hairs; two longer, thicker hairs on each scutellum. Pleural surfaces unevenly blackish brown to brown, glossy, with few scattered, very thin, pale hairs; coxae yellowish brown ventrally, grading into brown dorsally, front and middle coxae bearing long, pale hairs on anterior surfaces; mera brown. Femora not noticeably enlarged in either sex, yellowish brown, covered with closely-set rings of tiny setae but without spines. Tibiae dark yellowish brown basally, darkening to brown at apex, with rings of tiny setae throughout; no spines on fore tibia, 4–6 on middle tibia, and several on hind tibia, particularly on apical half; tibial spurs long, slender. Tarsi brown at base grading to dark brown distally, narrowly paler at joints; tarsomere 4 with 0–2 pairs of lateral spines; tarsomere 5 without spines; basitarsus of front leg about 7 times length of fifth tarsomere (more than twice as long as hind basitarsus) in both males and females; basitarsus of hind leg only about 3 times as long as fifth tarsomere in male, 4 times as long in female. Tarsomeres 3, 4 and 5 finely toothed along their opposing edges; pretarsal claws slender, nearly straight in basal three-fourths, gently curved near tip.

Wings (Figs. 1, 7) moderately iridescent, evenly darkened with smoky yellowish brown, stigma only slightly darker; diffuse gray clouding along cross-veins in radial and medial fields. Subcosta in forewing ending in costa slightly beyond first fork of radial sector (FRs), subcostal cross-vein (Scv) opposite FRs. No pterostigmal cross-veins, but a single cross-vein between R_1 and R_{2+3} about half-way between Scv and proximal end of stigma. Vein R_1 with short transverse branch to C near base of stigma, in many individuals an indication (concentrated row of setae) of diagonal second branch near mid-length of stigma. Vein R_{2+3} unbranched; Rs, R_{4+5} and R_5 nearly in alignment; usually only one cross-vein between R_{2+3} and R_4 but two or

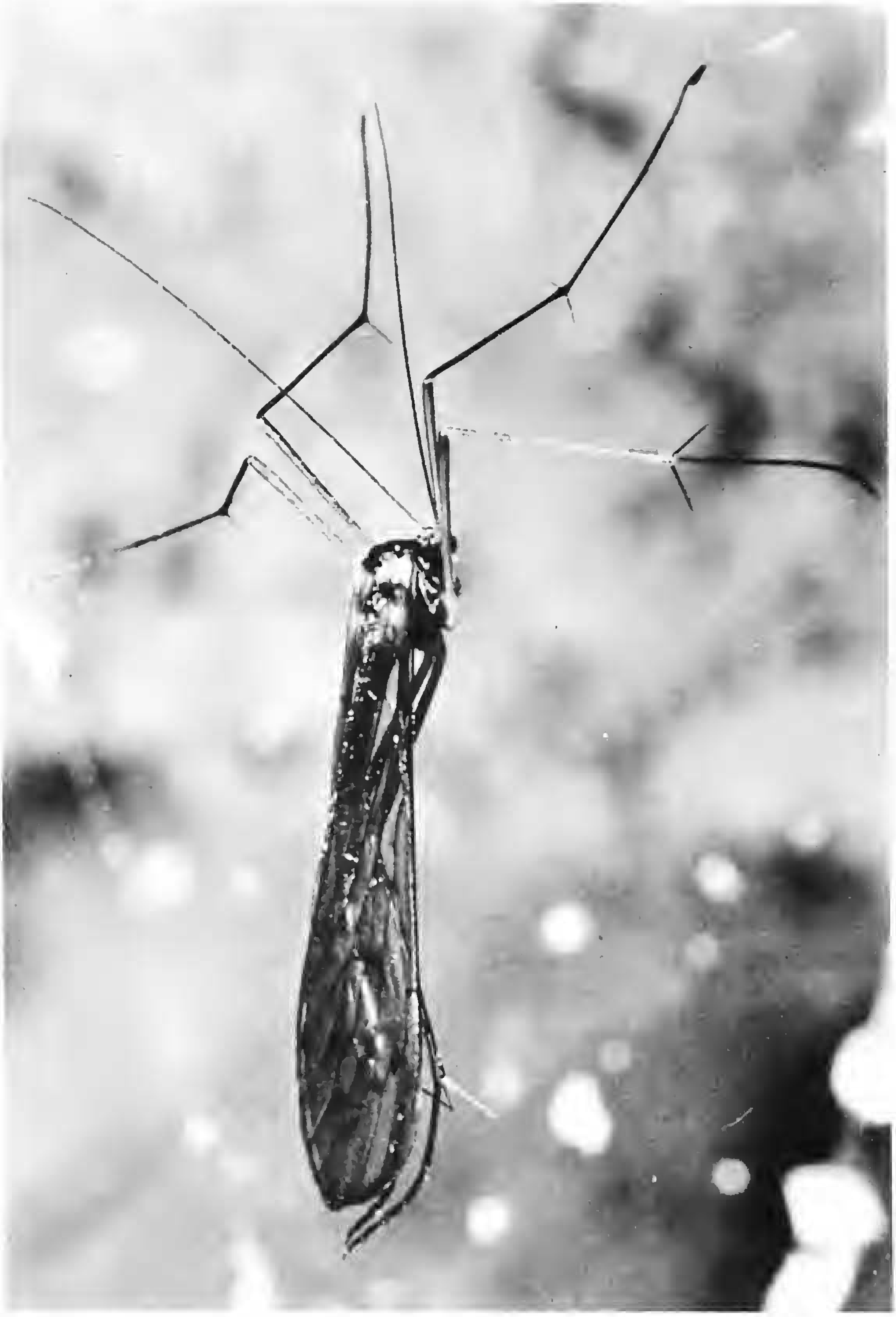
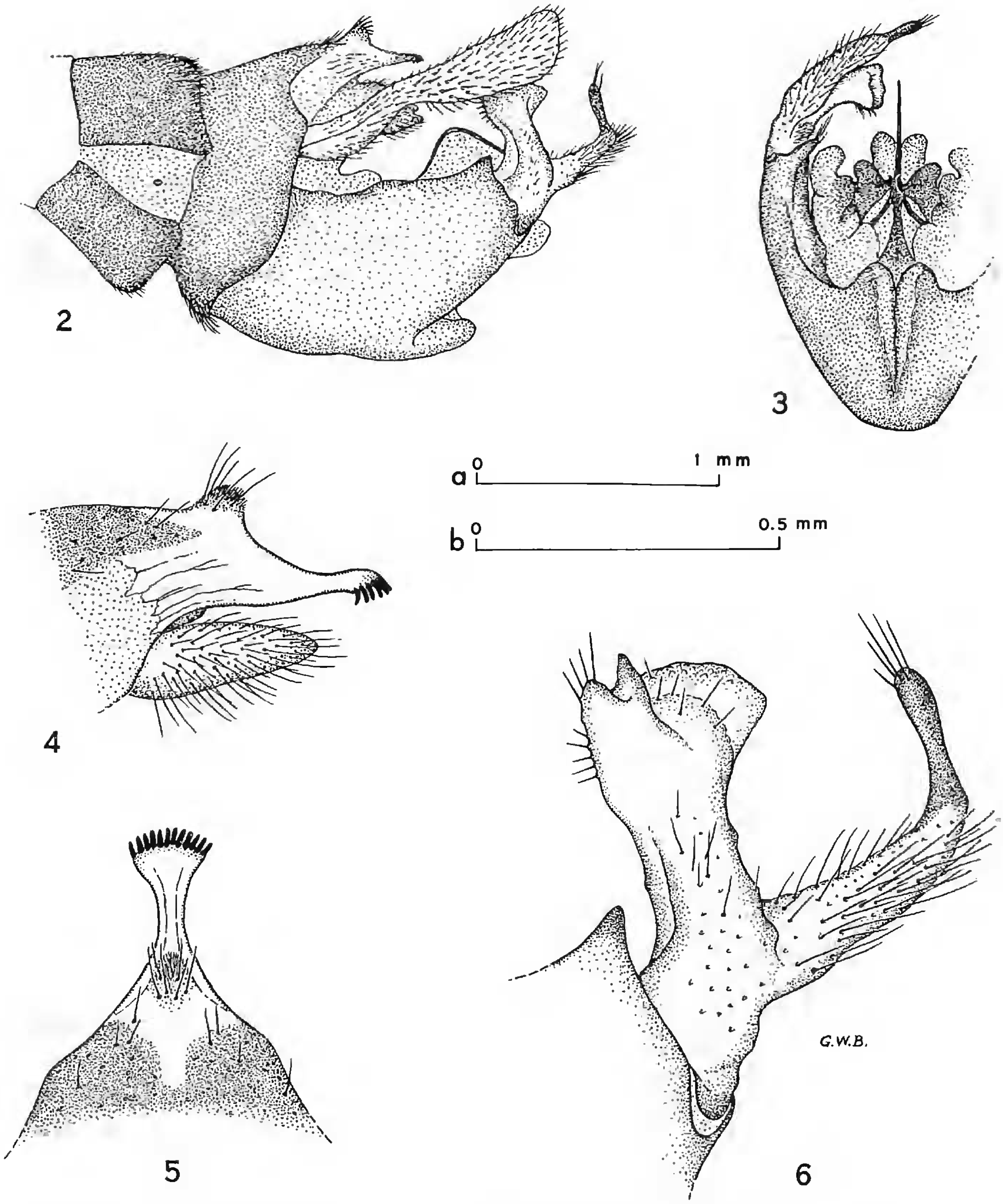


Fig. 1. *Orobittacus obscurus*, new genus and species, dorsolateral aspect of individual suspended from spiderweb in typical resting posture. Photograph by B. Villegas.

rarely three present in one or more wings of some individuals; R_4 rarely forked. Conspicuous thyridium at first fork of media; only one cross-vein between M_1 and M_2, none between M_3 and M_4; vein M_{3+4} branching well beyond m-cu cross-vein. Small thyridium at junction of M_{3+4} and m-cu, another on short cross-vein between Cu_2 and 1A near base of wing. Vein 1A extends to level of origin of Rs; 2A extends almost to level of origin of

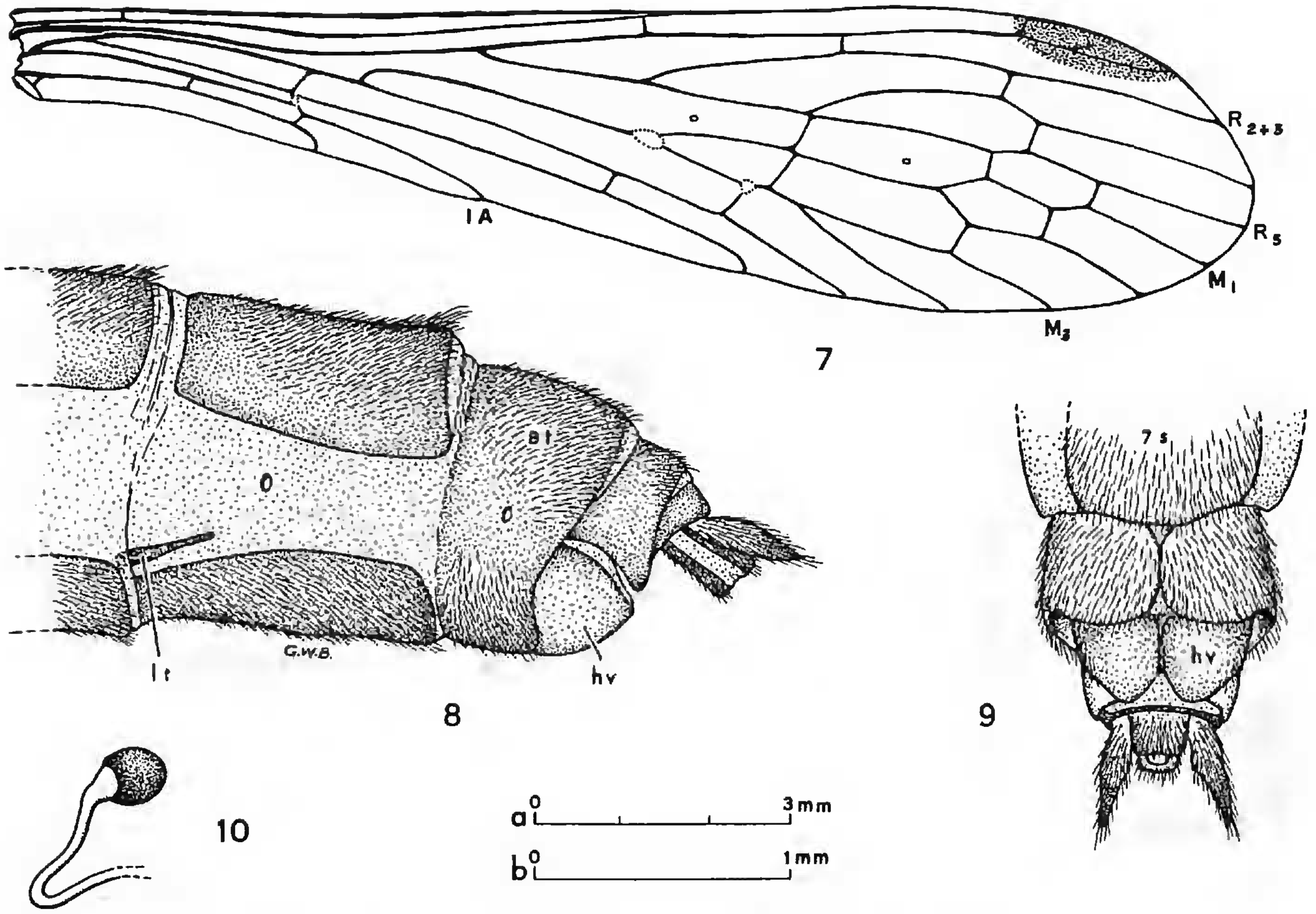


Figs. 2–6. *Orobittacus obscurus*, n. sp., details of terminal abdominal segments of male paratype. Fig. 2, terminal abdominal segments, left lateral aspect. Fig. 3, basistyle, dististyle, aedeagus and associated structures, posteroventral aspect; most of right side omitted. Fig. 4, ninth abdominal tergum and epiproct, left lateral aspect. Fig. 5, posterior process of ninth abdominal tergum, dorsal aspect. Fig. 6, left dististyle, left lateral aspect. Scale a, Figs. 2–3; scale b, Figs. 4–6.

M; 3A short, inconspicuous. In hindwing, Sc ends in C well before FRs, Scv opposite mid-length of Rs or slightly more proximal; veins 2A and 3A fused with 1A except for short terminal segments.

Abdomen of male.—Terga 2–5 dark brown, 6–8 shining black; corresponding sterna similarly colored. Segment 9 a continuously sclerotized ring, abruptly paler than 8, brown dorsomedially paling to sordid yellowish brown at sides, dark yellowish brown ventrally. Basistyles, most of dististyles, and cerci pale yellowish brown. Slender, wedge-shaped laterosternite at each side of sterna 2–7, attached very narrowly to anterolateral corner of sternum on segments 3–7 (attachment usually concealed by fold of pleural membrane), attached more broadly to separate anterior portion of sternum 2. No spines on sides of anterior terga. Tergum 9 totally lacking epiandrial lobes, produced caudad as a complex median lobe (Figs. 2, 4, 5) with darkened, dorsal, setiferous prominence and more ventral, slender process abruptly widened at apex and bearing about 12 thick, downcurved, black spines. Proctiger not conspicuous, but cerci arising from its sides (Fig. 2) greatly enlarged, flattened (compressed), gradually expanded toward diagonally truncate apex, slightly bent and constricted near mid-length, with subapical hairs on mesal surface directed cephalad. Basistyles deeply separated, connected ventrally by membranous cuticle, each with submedian ventral protuberance, acute, blade-like point just above base of dististyle and slender, setiferous projection directed mesad below base of dististyle (Fig. 3). Conspicuous membranous structure, appearing as inflated, four-chambered pouch in specimens preserved in fluid (Fig. 3), adjacent to inner surface of each basistyle (may be homolog of pheromone sac of Panorpidae; tergal pheromone sacs not evident). Dististyles (Figs. 3, 6) large and complex (as compared to those of Bittacidae in general), deeply divided, comprising a stout anterodorsal arm with shallow mesal concavity at apex and a more slender, curved, posteroventral arm with pale basal portion bearing numerous dark setae, and darkly sclerotized, mostly glabrous distal portion with small tuft of setae at apex. Aedeagus (Fig. 3) a slender filament with basal membranous pouch at each side, median dorsal sclerotized band above pouches, and pair of flattened, sclerotized ventrolateral appendages (possibly homologs of ventral parameres of Panorpidae) each with broad, rounded subterminal lobe and sharp, curved tip.

Abdomen of female.—All terga and sterna unevenly brown to dark brown, terga 2 and 3 somewhat darker than others. Laterosternites on segments 2–7, shaped and attached as in male. Segment 8 continuously sclerotized except along ventral mid-line (Figs. 8, 9); hypovalves subtriangular, hinged to each other and to basal eighth sternum by lightly sclerotized cuticle. Ninth tergum saddle-like, sternum 9 lightly sclerotized, pale except for slender dark ring around aperture of bursa (spermathecal duct). Tenth segment



Figs. 7–10. *Orobittacus obscurus,* n. sp., wing of male and details of abdomen of female paratype. Fig. 7, right front wing of male paratype; A—anal vein, M—media, R—radius. Fig. 8, terminal abdominal segments of female, left lateral aspect; hv—hypovalve of ovipositor, lt—laterosternite, t—tergum. Fig. 9, terminal abdominal segments of female, ventral aspect; hv—hypovalve, s—sternum. Fig. 10, spermatheca and portion of spermathecal duct. Scale a, Fig. 7; scale b, Figs. 8–10.

mostly membranous ventrally but caudal margin sclerotized, forming continuous ring with tergum; tergum and sternum of segment 11 moderately sclerotized; cerci pale at base, darkened toward acute apex. Spermatheca (Fig. 10) darkly sclerotized except around attachment of short, thick spermathecal duct. Nearly mature eggs oval in outline, ends equally rounded; chorion dark yellowish brown.

Body length, male, about 14.5–16.8 mm (M = 15.7; holotype 16.0 mm); female, 14.0–15.7 mm (M = 15.0; allotype 14.0 mm). Length of front wing, male, 16.2–17.9 mm (M = 16.9; holotype 17.9 mm); female, 16.5–17.0 mm (M = 16.8; allotype 16.6 mm).

Types.—Holotype, male, labelled "California, El Dorado Co. #3, American Riv., 11.4 mi. W. of Kyburz, 6 June 1976, 3040 ft., G. W. Byers, B. Villegas." Allotype, female, and 15 ♂, 8 ♀ paratypes, same label data as for holotype. Additional paratopotypes, 211 ♂, 156 ♀, various dates from 10 May to 4 July, most early June 1976–1979. Additional paratypes, 50 ♂, 33 ♀, Shirttail Creek, 6.4 km northeast of Foresthill, Tahoe National Forest, Placer Co., California, 27 May and 7 June 1976. The type locality is the vicinity of a U.S. Forest Service picnic area near Bridal Veil Falls, El Dorado National Forest, between U.S. Highway 50 and the South Fork of the American River, about 18 miles east of Placerville. Holotype, allotype and initially 331 paratypes in the Snow Entomological Museum, University of Kansas, Lawrence, Kansas; 142 paratypes in the collection of the University of California at Davis. Paratypes will be distributed from the Snow Museum to other entomological collections, including the California Academy of Sciences, the Los Angeles County Museum, the California Insect Survey, the U.S. National Museum of Natural History, the Museum of Comparative Zoology at Harvard University, the Illinois Natural History Survey, Cornell University, the University of Michigan, the Florida State Collection of Arthropods, the British Museum (Natural History), and the Australian Museum.

Habitat

At the type locality, the American River flows generally westward between steep (50–60°), rocky but largely forested slopes. The river flows among huge boulders (Fig. 11), and the lower slopes are strewn with boulders and rocks of all sizes broken from the outcrops above. Soil trapped on the slopes and forming the short, narrow floodplain at this site is sandy but humous. The forest is dominated by three conifers, Ponderosa Pine (*Pinus ponderosa*), Incense Cedar (*Calocedrus decurrens*) and Douglas-Fir (*Pseudotsuga menziesii*). It also includes Big-leaf Maple (*Acer macrophyllum*), dogwood (*Cornus sessilis*), hazelnut (*Corylus cornuta*), occasional oaks, and, along the stream, White Alder (*Alnus rhombifolia*) and willow (*Salix* sp.). Particularly on the north-facing slope, a variety of mosses are common on outcropping rocks, boulders, fallen logs and soil, where these substrates are more or less continuously moist and shaded. The herb-grass-fern stratum is generally well developed. Elevation at the floodplain is approximately 935 meters, or 3040 feet.

The habitat at the Shirttail Creek site is much the same, differing chiefly in the much narrower stream, the somewhat steeper slopes along it, and generally slightly drier conditions. In addition to the three dominant conifers, Jeffrey Pine (*Pinus jeffreyi*), California Black Oak (*Quercus kelloggii*) and Canyon Live Oak (*Q. chrysolepis*) are common on the slopes. Dogwoods, hazelnuts, alders and willows are common nearer the stream. Elevation is approximately 1060 meters, or 3440 feet. Shirttail Creek flows generally southwestward to join the North Fork of the American River.

During the day, *Orobittacus* usually seeks darkly shaded crannies in which the humidity is high. Often, such resting places are beneath tree roots

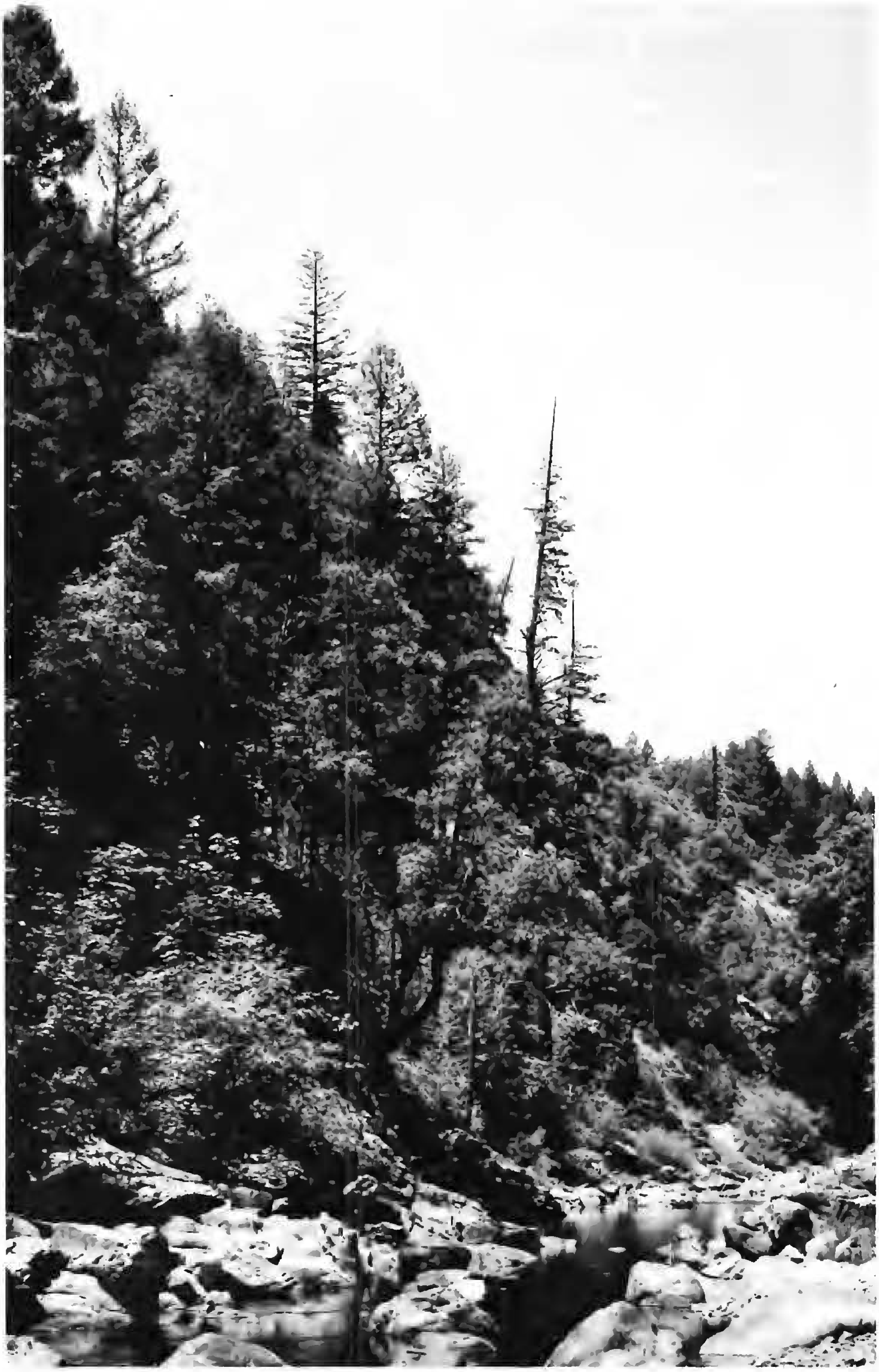


Fig. 11. Habitat of *Orobittacus obscurus*, n. sp., on left bank of South Fork of the American River, 11.4 miles west of Kyburz, El Dorado County, California. Dominant forest trees are Ponderosa Pine, Incense Cedar and Douglas Fir. Photograph by B. Villegas.

in overhanging banks, below rock outcrops and in deep shade beneath fallen logs, and along streams beneath large boulders even near the water's edge.

Habits

In their day-time hiding places, individuals of *Orobittacus* will be found ordinarily hanging by their more or less outspread front and middle legs, with the hind legs held close together along the ventral side of the abdomen, the tarsi curving dorsad around the tips of the folded wings (Fig. 1). Because of their dark color, they are not easily seen when thus suspended motionless in darkened crannies; hence their specific name, *obscurus.*

Places where *Orobittacus* hides by day are often inhabited by spiders, and it is common for the hanging-flies to suspend themselves from spiderwebs when at rest. Occasionally they become entangled, however, and are preyed upon by the spiders. Fungus gnats (Mycetophilidae) abound in many of the niches occupied by *Orobittacus* and constitute the main prey of the bittacids; they are also frequently trapped in the spiderwebs. Male and female *Orobittacus* captured with prey were carrying fungus gnats; one was also seen feeding on a small crane fly (Tipulidae).

Courtship and mating have not been observed, either in natural surroundings or when the insects were caged. This behavior is presumed to occur at night, when *Orobittacus* has been seen leaving its day-time retreats.

Geographical and Seasonal Distribution

Orobittacus obscurus is known from only the two localities mentioned above, both on the western slopes of the central Sierra Nevada and only about 50 km apart. The abruptly increasing elevation of the mountains to the east and the relatively dry, hot and treeless central valley to the west would seem to be natural barriers to the spread of the species. We have sought *O. obscurus* in apparently suitable habitats both to the north and south of El Dorado and Placer counties but without success.

Since the earliest and latest collections of *Orobittacus* (10 May and 4 July) yielded only small numbers of individuals while those made near the middle of this period (29 May to 9 June) were most productive, we judge that the type series more or less correctly indicates the seasonal distribution of the species.

Acknowledgments

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Footnotes

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